

using the instrument for the first time on this day an estimate of the work done by children who had repeatedly used the ergograph might help to eliminate this possible error. Eleven children familiar with the instrument did an average of 204 kg. cm. of work at 9.30 and 256 at 11.30, so that there seems no way that we can use these figures to obtain results similar to those obtained by Dr. Christopher. This may be accounted for by a difference in the school curriculum. It is possible that the duties required of the pupils in Chicago are more difficult and that the sessions possess less opportunities for recesses. This would, of course, alter the results. As I have been unable to obtain the curriculum used in Chicago I cannot compare it with that used in New York.

As a conclusion, I might say that the Crampton test for fatigue has given negative results as applied to school children in New York; that the Storey ergograph as used for the detection of fatigue in school children has given negative results and is unsuitable on account of the use of accessory muscles when the abductor indicis becomes fatigued; that the Mosso ergograph combined with an adder as used in the Chicago public schools is the more reliable instrument for this purpose, but in my hands fails to give evidence of marked fatigue of the pupils during the school day in a private and also in a public school of New York City; and that in occasional children either form of ergograph will give evidence of fatigue.

The ergograph, so far as my work indicates, is of no value in modifying the school day in the public schools of New York for the average student, but might be shown to be of value in lightening and controlling the work for those pupils who give evidence of marked fatigue during the school day.

THE DIAGNOSTIC VALUE OF CUTANEOUS HYPERALGESIA (HEAD'S ZONES) IN ABDOMINAL DISEASE.

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ALTHOUGH fifteen years have passed since Henry Head first published his discovery of the association of increased sensitiveness of the skin with visceral disease, the literature of the subject has remained very small. Lange is said to have written about skin sensitiveness in visceral disease as early as 1871. Ross referred to

the subject in 1888, but Head was the first to make a careful study of the phenomena. Notwithstanding the importance of Head's publication, it seems to have attracted little attention outside of England. The papers of Mackenzie, Thorburn, Thane, and others, in England, and of Petren and Faber, on the Continent, are the only ones of importance that have appeared. In most of the text-books the subject has been dismissed with a few lines.

During the last two years we have made a large number of examinations in the wards of Mt. Sinai Hospital, to determine the presence or absence of areas of hyperalgesia in abdominal affections. The majority of the patients were admitted to the surgical service of Dr. Lilienthal, and were sooner or later submitted to operation, so that the results of our observations were verified by the operative findings. In the following paper are given the results of our studies, arranged under the following headings:

- I. Description of Head's zones.
- II. Methods to be used in testing for cutaneous sensitiveness.
- III. The appearance and disappearance of zones of hyperalgesia in abdominal disease.
- IV. The general significance of localized areas of cutaneous hyperalgesia in visceral disease.
- V. General consideration of the subject of hyperalgesic zones in abdominal disease.
- VI. Head zones in affections of the various viscera.
- VII. Conclusions.

I. DESCRIPTION OF HEAD'S ZONES.

In 1893 and later, Henry Head described certain definite and constant areas of cutaneous tenderness associated with diseases of the different viscera. He found that in many visceral affections, if the sensitiveness of the skin was tested by running a pin point over the cutaneous surface, there could be shown to exist areas over which there was a more or less marked hypersensitiveness to pain. As a result of painstaking investigations extending over many years, he concluded that these areas were constant and distinct; they could be mapped out on the surface of the skin, and, when present, were an almost infallible sign of an affection of the organ to which they corresponded. The skin tenderness was very superficial—quite different from tenderness on deep pressure—and extended over definite areas which never overlapped one another. Each area or "zone of hyperalgesia," as he called it, had a "maximum" region, which often corresponded to the location of the pain complained of by the patient, and coincided with the areas marked out by attacks of herpes zoster. Head found, also, that these areas were hypersensitive to heat and cold, but not to touch. He concluded that there is

an intimate association between the central connections for the nerves of the viscera and the nerves which supply the sensations of pain, heat, and cold, and those which exert trophic influences on the skin.

In his various publications, Head gave diagrams of the form and extent of these hyperalgesic zones. He showed that the areas corresponded to segments of the spinal cord, not to the distribution of peripheral nerves or spinal nerve roots or brain areas. Based on this segmental distribution, the zones were named according to the segments of the spinal cord: cervical, 1 to 7; dorsal, 1 to 12; lumbar, 1 to 5; sacral, 1 to 4. Head described the shapes of the zones, and stated that in general the zones were broader at the median line in front, became narrower at the side of the body, and again broadened out near the spinal column. The zones of each side never extended beyond the median line in front or behind.¹ Head stated, also, that there were individual differences in the form of the areas, but not in their general position, due to variations in the shape of the patient's body or in nerve supply.² For the abdominal viscera, Head gave the following zones:

Stomach, sixth, seventh, eighth, and ninth dorsal.

Cardiac end, sixth and seventh dorsal, right. ?

Pyloric end, eighth and ninth dorsal, left.

Liver, eighth, ninth, and tenth dorsal, right.

Gall-bladder, eighth and ninth dorsal, right.

Intestines, ninth, tenth, eleventh, and twelfth dorsal.

Colon, ninth, tenth, and eleventh dorsal.

Cecum and appendix vermiformis, tenth and eleventh dorsal, right.

Kidney, tenth dorsal, sometimes eleventh dorsal.

Ureter, eleventh and twelfth dorsal, first lumbar.

Bladder, (first?), second, third, and fourth sacral.

Uterus, tenth, eleventh, and twelfth dorsal, first lumbar.

Appendages, eleventh and twelfth dorsal, first lumbar.

To explain these areas of referred cutaneous hyperalgesia, Head proposed an hypothesis, which we here give in his own words:

"Why is the skin tender in consequence of visceral disease?"

"If impulses pass up the sensory nerves from an organ which is diseased to the cord, they will set up a disturbance in the segment of the cord to which they are conducted. Now, any second sensory impulse from another part conducted to the same segment of the cord will be profoundly altered. Under normal circumstances, it would have set up its own proper disturbance in the gray matter,

¹ In a few instances we have observed that the areas extended slightly across the median line in front. This can be explained on the basis of nerve filaments from one side supplying the skin a little beyond the median line.

² The outline of the zones, as determined by us, sometimes varied somewhat from Head's diagrams (see below).

and this disturbance would have been conducted to the brain. But now it no longer falls into a normal and quiescent cord, but into one whose activity is already disturbed. The resultant stimulus conducted upward is therefore a very different one from that which would have passed on under normal circumstances. In many cases the second stimulus will be exaggerated like rays passing to the eye through a convex glass. Thus, if any segment of the cord is disturbed by painful stimuli from an internal organ, a stimulus applied to the skin over the areas supplied by the nerve roots belonging to this segment will be exaggerated, and a stimulus which normally was perhaps only uncomfortable would now appear to be very painful.

"But in order that this condition may result, the central nervous connection between the sensory nerves from the viscera must be closely connected with that part of the cord into which the sensory stimuli from the skin are conducted. We never find cutaneous hyperesthesia or increased sensitiveness to touch as the result of visceral pain, but only increased sensitiveness to pain or hyperalgesia."

II. METHODS OF EXAMINATION.

No satisfactory and practical form of algesimeter for testing cutaneous hyperalgesia has thus far been devised.³ Head tested the skin sensitiveness to pain by pinching up folds of skin, or, later, by stroking the skin with the point of a sharp pin. We have made use of the pin method, and have found it satisfactory for practical purposes. A sharp pin is held between the thumb and index finger of the right hand, the nail of the index finger resting on the patient's skin. The pin is then made to traverse slowly the surface of the skin, care being taken that the nail of the index finger presses equally along the area examined. The patient is instructed to say "now" as soon as the pin stroke becomes painful.

In examining the skin of the abdomen for hyperalgesic areas, the pin traverses the abdomen from side to side and from above downward; the points at which the patient complains of pain are marked. In this manner it is possible to map out areas on the skin, and when such an area has been found, the pin is made to approach it from all sides, so that its form and position can be determined. Care must be taken that the pressure of the pin point remains constantly the same, especially as the pin passes over the groin and slips off the costal border or over the crest of the ilium.

After the zone has been thus mapped out on the skin the procedure is repeated a second time, and now it is a good plan for the operator to control both patient and himself by keeping both the patient's

³ The instrument described by Thudicum is not practical.

and his own eyes away from the pin. There is considerable variation in the sensitiveness of different persons; some will complain of pain with a pressure which others will hardly feel. It is therefore of advantage first to gain an idea of the general sensitiveness to pain of the patient.⁴

The hyperalgesia is sometimes so marked that the patient will shrink or cry out as soon as the border of the zone is reached. At other times one depends on the statements of the patient.⁵ In very young children, the examination is useless, but older children will give correct answers.

If the examination is carried out in the manner above described, it will be possible in a large number of patients with visceral affections to map out areas of hyperalgesia extending from the median line in front to the spines behind. We have succeeded in substantiating most of the statements made by Head in regard to the zones of referred cutaneous hyperalgesia in abdominal disease. The "maximum" areas can often be mapped out lying within the boundaries of the zones; sometimes only the "maxima" are present. We have sometimes found several "maxima" in one zone.⁶

A certain amount of experience is necessary before satisfactory results can be obtained, and this experience must be gained by frequent careful tests for cutaneous hyperalgesia. We have found, with increasing experience, an increasing number of positive cases.⁷

III. THE APPEARANCE AND DISAPPEARANCE OF ZONES OF HYPERALGESIA IN ABDOMINAL DISEASE.

The zones appear early in the course of visceral affections, and usually persist throughout the course of the disease. They disappear at once with the relief of the lesion. They may appear very early. Thus, in the very beginning of acute appendicitis, when the pain is still in the epigastric region, and there is no tenderness as yet in the right iliac region, there may be a well-marked appendix zone. The zones may appear after palpation, when they were not present before. Thus, we have seen the characteristic

⁴ For this purpose we have sometimes found a test proposed by Dr. Libman of value. If one makes pressure with the thumb over the styloid process in the neck, one may gain a fair idea of the degree to which an individual is sensitive to pain. Some patients will complain of the slightest pressure, in others a considerable degree of force is required. (Personal communication through kindness of Dr. E. Libman, adjunct physician to Mt. Sinai Hospital.)

⁵ It is often a good plan to control the patient's statements by testing the skin near the spine on the side opposite to that on which the zone has been found. This is, of course, done without the knowledge of the patient.

⁶ Although, in front, the hyperalgesia may extend only over a small "maximum" area, the examination of the skin of the back should never be omitted. There may be a sensitive area posteriorly which will make the identification of the zone more certain.

⁷ Thus, in the beginning of our investigations we were able to demonstrate zones of hyperalgesia in about 25 per cent. of cases of appendicitis; after some experience we have found "appendix zones" in almost 75 per cent. of the patients.

zone for the appendix appear after palpation of the right iliac region in acute appendicitis, and we have observed the zone for the uterine adnexa appear after a bimanual examination. Head states that, in one of his patients, after rough manipulation of a floating kidney, a "kidney zone" appeared.

In a few instances, we have been able to note the appearance of the zone while the patient was under observation. In these cases the zone usually appeared in its entirety. The presence of an ice bag, a hot-water bag, or a poultice may make it impossible for the examiner to map out the sensitive area, but if the ice bag or hot-water bag is removed, the hyperalgesic zone will appear after about fifteen minutes. Therefore, it is imperative to wait a short time after an ice bag, etc., has been removed before the examination is made.⁸

The disappearance of the zones is a question whose significance is often difficult of explanation. In general it may be stated that a prompt disappearance of the zone follows relief of the lesion of the affected viscus. We have, in a number of patients, been able to watch the disappearance of the zones. In some cases, the zone disappeared slowly as the condition of the diseased organ improved; the outlines of the hyperalgesia became irregular, until finally there was only a small area of hyperalgesia remaining. After several days it was impossible to state that the area found hypersensitive to pain corresponded to a segmental zone, because it had become so vague.

The zones may disappear after repeated examinations. Thus we have often observed that after the skin of a patient had been examined in succession by a number of the house staff, the zone became less and less distinct, and finally disappeared. After a short interval of rest the hyperalgesic area again appeared. We have always considered that this disappearance of cutaneous hyperalgesia after a number of examinations which followed each other in close succession was a sign that the nerves had become "tired out."⁹

The zones may disappear suddenly in the course of the visceral disease, with persistence or sudden increase in the general symptoms. We have seen this sudden disappearance of skin hyperalgesia in a number of instances, and shall speak of its significance later.

⁸ In some cases the hyperalgesia is so intense that the zone can be mapped out in spite of the fact that the skin is more or less anesthetic from the cold. Care, however, must be taken that the cutaneous tenderness due to a bruise or superficial abscess is not confused with referred cutaneous hyperalgesia.

⁹ It may be that the relief from pain obtained by the application of cold to the abdomen in acute abdominal disease is due to the anesthesia of the skin produced. On this theory we have, in some acute affections with Head zones, anesthetized the hyperalgesic area with menthol (50 per cent.). In some of the patients the pain was relieved.

IV. THE GENERAL SIGNIFICANCE OF LOCALIZED AREAS OF CUTANEOUS HYPERALGESIA IN VISCERAL DISEASE.

While the absence of a characteristic zone of cutaneous hyperalgesia in a suspected affection of an abdominal organ does not mean that there may not be a disease of that organ, the presence of the zone means that there is an undoubted lesion. From this one must not conclude that the viscus which gives the zone is the one which causes the symptoms, for we may get a zone from an organ which is secondarily affected. Thus we have seen, in several patients with marked abdominal distention in the course of typhoid fever, a zone of hyperalgesia of the tenth and eleventh dorsal segment on the right side corresponding to the cecum and vermiform appendix, an evidence of especial distention in those structures.¹⁰

The presence of a Head zone alone must not be the only factor in arriving at a diagnosis; it must be used in conjunction with other signs and symptoms. Used with circumspection, however, it will be found of value in very many patients.

The signs of not a few abdominal affections are so much alike that the presence of a Head zone may focus attention on one or the other organ, with the probability that the disease will be found in that organ. At any rate, the presence of a zone must focus the clinician's attention upon the corresponding organ, and lead to a more careful examination of the organ and its surroundings. When the symptoms and signs have left us in doubt which of several viscera was the seat of the lesion the presence of a zone corresponding to the one or other viscus has made the diagnosis possible. In not a few patients with marked abdominal distention and rigidity the presence of a characteristic zone has aided very much in making a differential diagnosis between disease of the gall-bladder and of the vermiform appendix, between disease of the gall-bladder and kidney, between disease of the appendix and female adnexa, etc. In early stages of abdominal disease, zones of hyperalgesia are also of value, and have aided us in making an early diagnosis.

There is no constant relation between the severity of the pain or the gravity of the lesion and the degree of sensitiveness of the skin; we have seen very marked zones with little subjective pain and slight lesions, and only slight hyperalgesia in patients with very severe pain and grave lesions.

A few facts must be mentioned concerning the significance in an abdominal affection of the sudden disappearance of a Head zone with the persistence of other symptoms and signs. We have given

¹⁰ After distending the sigmoid flexure with air or fluid by means of a tube introduced into the rectum, one can often find a characteristic zone of hyperalgesia of the tenth and eleventh dorsal segments corresponding to the sigmoid.

especial attention to this point, but have not yet reached any positive conclusion. We do not agree with those who have claimed that the sudden disappearance of a zone means relief of tension in the corresponding viscus. Based on this, some writers have claimed, in acute appendicitis, for example, that with perforation of the appendix the zone should be absent or should suddenly disappear. We have observed a large number of cases of perforative appendicitis with persisting Head zone. (See Affections of the Appendix.)

We have gained the impression, however, that with persisting or increasing symptoms, the sudden disappearance of a zone is a sign of ill-omen and cause for concern. Thus, we have seen several patients with mild symptoms of appendicitis and with a Head zone suddenly develop very severe symptoms, making immediate operative interference imperative. Examination just before the operation showed that the appendix zone had disappeared.

The subject requires further study before any positive statements can be made.

The presence of areas of skin hyperalgesia corresponding to several viscera may mean a combined lesion of several adjoining viscera, although in these patients one has to think of a disease of the spinal cord itself. In this connection the following case is of interest:

A young girl with indefinite abdominal symptoms and with some tenderness in the right iliac region was sent into the hospital with the diagnosis of chronic appendicitis. Examination showed that there was some tenderness in the appendix region and some abdominal rigidity, with fever. There was an extensive area of skin hyperalgesia extending over the right side of the abdomen from Poupart's ligament to above the free costal border. This at once directed attention to the vertebral column and spinal cord. Careful examination revealed a slight scoliosis of the dorsolumbar vertebræ. An injection of tuberculin was followed by a marked general and local reaction; the x-rays showed beginning disease of several vertebræ. The patient was suffering from early Pott's disease.

V. GENERAL CONSIDERATIONS.

In what follows we shall speak of the zones by the names of the viscera to which they correspond rather than to the spinal segments to which they belong. Thus, we shall speak of gastric, gall-bladder, appendix, kidney zones, etc. Head has demonstrated conclusively the visceral associations of the various hyperalgesic areas; we believe it will add to the clearer understanding of the zones if they are directly named according to the viscera to which they correspond.

We desire to call attention to the fact that the zones of hyper-

algnesia that we have found differ somewhat from the zones described by Head, both in outline and extent. Thus, the stomach zone, according to our experience, corresponds to the seventh, eighth, and ninth segments of Head (according to Head, sixth, seventh, eighth, and ninth); the gall-bladder zone to the eighth and ninth segments on the right side (same as Head's diagrams); the appendix zone, according to our experience, tenth and eleventh segments of Head on the right side. In our diagrams we have drawn the zones as we have found them in our cases. It will be

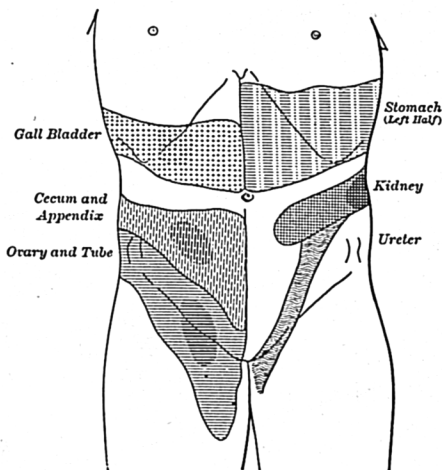


FIG. 1.—The general location and outline of the zones of cutaneous hyperalgesia for some of the abdominal viscera. Anterior view. The maxima are deeply shaded. Only the left half of the gastric zone is given. The ureteral zone consists of a series of maxima (diagrammatic).

found, in the description of the zones, that we do not absolutely limit the posterior portions. Thus, we say, in describing the gastric zone, that it extends from the sixth to the tenth vertebrae, approximately. The zones, except the gastric zone, stop sharply at the posterior median line, but their upper and lower margins are more variable.

The zone appears on that side of the body on which the affected organ has its nervous connections; the side on which the organ is normally situated. If an organ belongs on the left side, the hyper-

algescic zone will be found on that side, even if the organ, through disease or mobility, lies on the other side of the body.

We will call those areas "objective zones" when the patient suffers actual pain as the stroking pin enters them. All less painful zones will be called "subjective zones." By an "anterior zone" we mean an anterior maximal area; by a "posterior zone," a posterior maximal area.

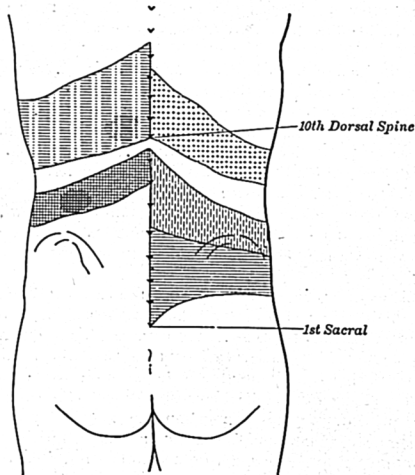


FIG. 2.—The general location and outline of the posterior parts of the zones (diagrammatic).

THE STOMACH. We have examined only a small number of patients with gastric affections, and have found the zones more variable in extent and configuration than in any of the other abdominal diseases. Head, in his original paper, stated that the gastric zones appeared most often on the right side. We have found that a complete gastric zone is uncommon. It extends as a broad belt all around the body. In the median line in front it extends from the xiphoid almost to the navel; it then passes upward and backward on both sides toward the spine, where it extends from the sixth to the tenth vertebra (approximately). Incomplete zones are more frequent, either an anterior portion extending to the right or to the left, or on both sides of the anterior median line. Zones were present in some of our cases of chronic gastric diseases with pain

(carcinoma, benign stenosis of the pylorus, chronic bleeding ulcer); more often in acute gastric affections (ulcer, acute dilatation, gastritis). We present a few illustrative cases:

Acute Bleeding Ulcer. There was a well-marked gastric zone in its left half, while the bleeding was going on; when bleeding and pain ceased, the zone disappeared simultaneously.

Benign stenosis of the pylorus in a patient who vomited once a day, at which time he had considerable pain and tenderness. Several times, after the vomiting, a complete gastric zone could be mapped out; at other times, only the anterior half on the zone was present.

Benign Stenosis of the Pylorus; Cholelithiasis. Five years' history of cholecystitis. During the last six months, occasional vomiting and frequent eructations not associated with attacks of cholecystitis. There were dull pain and moderate tenderness in the right hypochondrium; frequent nausea and eructations; vomiting. There was a complete gall-bladder zone extending to the left as far as the anterior axillary line, a narrow strip of hyperalgesia corresponding to a section of the gastric zone. At the operation there was found a small gall-bladder contracted about numerous stones and dense pericholecystitic adhesions which kinked the pylorus to an acute angle.

In visible gastric peristalsis from various causes, we have at times observed the anterior part of the gastric zone appear, and disappear when the peristalsis ceased. We have not found gastric zones in patients who had gastric symptoms (nausea and vomiting) in the course of acute abdominal affections, such as appendicitis, cholecystitis, etc., but the zones corresponding to the diseased viscera were present. In this connection the zones have sometimes been of diagnostic value, as in the case of a female, aged fifty years, who was admitted to the hospital on account of repeated vomiting, with generalized abdominal pain and tenderness. The search for skin hyperalgesia revealed not a gastric zone, but one for the uterus and adnexa. The lesion proved to be a retroflexed uterus with diseased adnexa, and the vomiting was reflex.

Before leaving the subject of gastric zones, we desire to add a remark on the subject of the so-called tender point in gastric ulcer that is often found on the back opposite the tenth dorsal vertebra. Many patients point to this as the region of greatest pain. This tender point will be found to lie within the area of gastric hyperalgesia, and to correspond to the posterior maximum of the gastric zone. This fact may be the explanation of the tenderness and pain experienced in this region by many patients with gastric ulcer.

THE DUODENUM. The duodenal zone lies between the gall-bladder and the appendix zones. It lies almost completely to the right, but in two of the patients extended slightly to the left of the anterior median line. Anteriorly it is broad; its upper limit is

about on a horizontal line andway between the umbilicus and the ensiform cartilage; its lower border is a little below the umbilicus. It extends backward and slightly upward, and narrows; at the anterior axillary line it is very narrow (about $1\frac{1}{2}$ inches); it then becomes broader, and is lost about the midscapular line. It corresponded roughly to the ninth right dorsal zone of Head in the few patients we have examined.

No.	Disease.	Symptoms.	Zone.
1.	Perforated ulcer.	Fever, acute abdominal symptoms.	Well-defined.
2.	Bleeding ulcer.	Melena, colic, slight tenderness.	Well-defined.
3.	Bleeding ulcer.	Melena, colic, slight tenderness.	Well-defined.
4.	Bleeding ulcer (chronic).	Slight pain and tenderness.	Absent.

The diagnostic significance of Head's zones was well illustrated in Case 1:

Perforated Duodenal Ulcer, with Hyperalgesic Zone Corresponding to the Duodenum. The patient entered the hospital with a three days' history of abdominal cramps, which became localized in the right half of the abdomen; at the onset he vomited and was constipated. A similar attack four weeks before had been treated as appendicitis. On admission, temperature, 101° ; pulse, 100. General condition fair; slight rigidity of right rectus muscle; moderate tenderness a little below and to the right of the umbilicus. The patient was supposed to have a mild appendicitis. There was indistinct hyperalgesia on the right side above the navel. The following day the temperature was normal, and the patient complained of cramps in the right lower abdomen. Physical signs unchanged, except that a well-marked duodenal zone was now present. Although the zone of hyperalgesia was recognized as duodenal, the diagnosis of appendicitis was adhered to. The operation, on the following day, revealed a small perforation of the duodenum from an ulcer in its descending portion with numerous adhesions around it.

GALL-BLADDER AND LIVER. According to our experience, a zone is present in acute affections of the gall-bladder more often than in any other acute intra-abdominal affection. In these cases the Head zone has often been a valuable diagnostic aid. In many cases an enlarged, tender, and palpable gall-bladder makes the diagnosis easy, but the recognition of the disease is often difficult or impossible in stout patients without jaundice, with marked abdominal distention and rigidity. These patients may refer their pain to the right lower abdomen, and may have their tenderness in this region. Acute intestinal obstruction, acute pancreatitis, or acute appendicitis are diagnoses often made. In some patients the presence of a zone of hyperalgesia has been the only localizing sign.

The gall-bladder zone lies in the right half of the abdomen, above the level of the umbilicus. The complete zone starts exactly at the median line in front, extending from some distance below the

xiphoid to a short distance above the navel. Tracing it backward, it slants obliquely upward and becomes narrow, passing partly over and partly below the costal arch. It is narrowest at the midaxillary line, where it is about two inches wide. Posteriorly it becomes broader, and at the spines it is about as wide as in front. In some cases, more or less of the anterior portion only has been present (maximal area).

In 21 cases of acute cholecystitis a zone was present eighteen times. The complete zone was present eleven times, the anterior part alone eight times. The zone was present four times in 5 cases of gangrenous cholecystitis; it was found in all 3 cases of empyema, and in both cases of acute cholecystitis with seropurulent peritonitis that were examined.

In the following illustrative cases the zone was an important diagnostic aid:

Acute Cholecystitis and Cholelithiasis; Diagnosis impossible on Account of Delirium. Female, aged seventy years, admitted with a three days' history of general abdominal cramps, never localized; vomiting and fever. On admission the patient was very delirious; the abdomen was everywhere rigid, and seemed to be everywhere tender. Temperature, 105.4°. There was a marked objective anterior zone for the gall-bladder, and this was the only means of locating the lesion. The operation was done under local anesthesia, and revealed acute cholecystitis with pericholecystic abscess, due to calculi. If general anesthesia had been employed, palpation of the enlarged gall-bladder might have been possible, but because of the patient's poor condition, local anesthesia was used.

Acute Gangrenous Cholecystitis Presenting the Symptoms of Acute Intestinal Obstruction. Female, aged forty years, with four days' history of severe epigastric cramps, persistent vomiting, absolute constipation. Enemas ineffectual. Under observation, patient vomited feculent material. The abdomen was markedly distended, rigid, and very tender in its entire upper half. No mass. Complete gall-bladder zone. Acute gangrenous cholecystitis was found at operation.

In a second case, similar to this one, there was a marked anterior zone. A third case, however, with similar symptoms, had no zone.

Acute Gangrenous Cholecystitis with Reflex Anuria in a Patient with Old Renal Disease, Simulating Pyonephrosis. In a male, aged forty-three years, there was a two years' history of a right kidney disease, with occasional attacks of renal colic and pyuria; four days before admission severe pain in the right upper abdomen, vomiting, and diminution of urine. These symptoms persisted, the pain radiating to the right flank, the vomiting frequent, and the urine scanty and turbid. On admission, moderate tenderness in the entire right upper quadrant of the abdomen, marked rigidity of

the right rectus, especially in its upper half; no mass. Neither kidney palpable, but palpation for the right kidney very painful. Temperature, 103°. Urine slight in amount (7 ounces in twenty-four hours), full of pus, albumin, and casts. Moderate oedema over both tibiae. There was a marked complete zone for the gall-bladder. The clinical diagnosis was pyonephrosis with partial reflex anuria. The day after admission, however, the rigidity had partly disappeared and an enlarged, very tender gall-bladder was palpable. The zone persisted. Temperature remained high, and the patient was operated on and an almost completely gangrenous gall-bladder was found. The infection from the cholecystitis had probably interfered with the function of the kidneys, one of which was seriously damaged. This view was borne out by the post-operative course; after a few days the patient passed much larger quantities of urine.

In the less acute affections of the gall-bladder the zone is often present, but is not of such diagnostic value, because there is less rigidity of the abdomen and more localization of the symptoms. However, we have seen a number of patients at the end of an attack, or after an attack, in whom the presence of the zone has materially helped us to make the diagnosis. The following is an example:

Calculus in the Cystic Duct, with a History of Attacks Diagnosed as Appendicitis. A boy, aged twenty years, was admitted to the hospital with the history of an attack of right iliac pain and vomiting two years before. His present attack began four days before admission, with severe non-radiating pain in the right lower abdomen. No vomiting, no urinary symptoms, no jaundice. Twenty-four hours before admission the pain had subsided, and at the time of admission there was no pain. The physical examination was negative. There was a moderately developed anterior zone for the gall-bladder, of typical shape. Previous attacks had been diagnosed as appendicitis. At the operation the appendix was normal; the gall-bladder was small, contained a large stone lodged in its neck, with numerous pericholecystic adhesions.

In chronic cholecystitis due to cholelithiasis, zones are often present, although diagnosis without them is usually easy from the characteristic history. Some of the cases, however, present a history that is purely gastric, and, if a zone is present, it may aid in the differential diagnosis. We have examined 19 cases of chronic cholecystitis and cholelithiasis that entered the hospital with histories of previous attacks; 11 of these had zones, mostly of the incomplete anterior variety.

An illustrative case with a gastric history:

Chronic Cholecystitis, with Vomiting and Epigastric Distress. Female, aged thirty-eight years, had for two years frequent attacks of nausea and eructations after eating, and occasionally vomiting. There was constant dull pain in the epigastrium. On two occasions

there were sharp sticking, non-radiating epigastric pains. The physical examination and gastric findings were negative. At the first examination there was no zone. On the fourth day of observation the patient "ate something that did not agree with her," and had more epigastric pain than usual; there was now present an anterior, moderately developed gall-bladder zone. The operative finding was a markedly thickened gall-bladder, with adhesions that stretched to the duodenum, and several large calculi.

In pancreatic disease with dilated gall-bladder a zone for the gall-bladder is sometimes present. We have seen 5 cases of carcinoma of the head of the pancreas with dilated gall-bladder, in 2 of which an anterior gall-bladder zone was present. Two cases of chronic pancreatitis with distended gall-bladders were seen; both had anterior gall-bladder zones. We do not know if pancreatic zones exist. In several cases of acute and subacute pancreatitis that we have studied there was no skin hyperalgesia. In abscess of the liver, in acute congestion of the liver (from cardiac disease, etc.), and in cirrhosis of the liver, we have found in some of the cases hyperalgesia over the lower right chest. The areas of hyperalgesia were very irregular, and corresponded to no zone.

KIDNEY AND URETER. The kidney zone is wide at the posterior median line, where it begins, and gradually narrows anteriorly. Its greatest breadth is at the spinal column. It narrows to make a triangular area, with a rounded apex, situated a little to that side of the anterior median line on which the zone lies. We have never seen the kidney zone quite reach the anterior median line. Each zone is strictly limited to its half of the body. There is no difference in contour between the right and left kidney zones. The kidney zones are complicated by the additional ureteral zones that are present in certain cases. The ureteral zone springs, so to speak, from the lower margin of the kidney zone at the anterior axillary line. In an average adult it is about three inches wide at this beginning. It narrows in its downward course, and passing obliquely downward and forward, it terminates on its side of the penis and scrotum in the male; the labia in the female. After the first narrowing it widens again well below the umbilical level. In the male, after this swell, it can be ascertained that the zone spreads fan-shape to the anterior median line over the pubic area and its half of the scrotal and penile skin. There are anterior and posterior kidney maximal areas. The ureteral zone seems to be made up of a series of maxima. The kidney and ureteral zone is most often present, as in the other intra-abdominal affections, in the presence of pain and tenderness.

We have examined 14 patients with renal calculus, and have found a more or less marked zone six times. In most of the cases in which the symptoms were slight no hyperalgesia could be demonstrated. Two of four cases of pyelitis had zones, as had one patient

with an acute pyelonephritis; one of infected hydronephrosis due to calculi, one of septic infarct in acute endocarditis, one of pyonephrosis. The more acute the renal affection, the more apt is there to be a cutaneous hyperalgesia. Thus we have not found a zone in the large majority of patients with tumors of the kidney, with the exception of one case, in which the operation showed that there was a large fresh hemorrhage into the tumor.

When a calculus passes into the ureter from the kidney, the kidney zone is apt to disappear and a ureteral zone develop. We have observed this in several instances, and have been able to follow the passage of the calculus along the ureter by means of the skin hyperalgesia. Of 8 cases of stone in the ureter, there was a more or less well-marked zone in 6. In a case of rupture of the kidney, there developed a well-marked ureteral zone after a severe colic. The colic and zone disappeared after the passage of a blood clot. The diagnostic value of localized areas of skin hyperalgesia in kidney and ureteral affections is not as great as in other abdominal affections, but in some patients it has had practical usefulness. In one case the findings were of considerable interest:

Calculus Anuria; Left-sided Pain; Right-sided Zone. A man was admitted to the hospital with a three days' history of pain in the left flank and almost complete anuria. On admission he was drowsy, and did not complain of pain. There was a marked objective zone for the right kidney. At operation there was found a double calculous pyonephrosis; the left kidney was atrophic and did not contain any urine; the right kidney was less diseased, was the seat of recent inflammation, and contained some urine.

Experience may show that in cases of this kind the zone may help in determining which kidney should be operated upon.

The presence of a ureteral zone on the right side has helped us to distinguish ureteral calculus from appendicitis in several cases, but our experience has been too small for any positive statements as to its value. We believe that the absence of a ureteral zone and the presence of an appendix zone make the diagnosis of a ureteral calculus at least doubtful, even though there are well marked urinary symptoms. On the other hand, the presence of a ureteral zone must make one suspect trouble in the ureter, in spite of absence of urinary symptoms. In this connection the following case is of interest:

Suspected Ureteral Calculus on Account of Suspicious X-ray Shadow and Red Blood Cells in the Urine; Well-marked Appendix Zone; Appendix Found Diseased. A man, aged forty-four years, gave a history of sharp pain in the right lower abdomen for three days. On admission there was tenderness in the right iliac fossa, slight rigidity of the rectus, temperature, 101°. There was a moderately developed anterior zone for the appendix. The urine contained a few casts and pus cells. During the four succeeding days

there was pain at times. The zone disappeared in two days. After cystoscopy and ureteral catheterization, there were a few red blood cells in the urine. X-ray showed a "suspicious shadow" in the lower part of the right ureter. The ureter was exposed by the extraperitoneal route, and was found empty. The peritoneal cavity was opened, and a very adherent, acutely inflamed appendix was removed.

VERMIFORM APPENDIX. The zone begins at the median line in front, sometimes a little to its left, from a point a short distance below the umbilicus to one equally distant from the symphysis pubis. It narrows toward the anterior axillary line to a width of about two inches (average adult). From this line it widens and spreads to the posterior median line from the eleventh dorsal to the second lumbar spines (approximately). At the anterior median line there is often a tongue-like downward extension of the zone (see diagram). There is an anterior maximal area which is sometimes present alone. We have not seen posterior maxima. It may be that the "appendix" zone is really an "appendix and cecum" zone, because the cecum is so frequently involved in appendicitis. Sometimes, when an ice-bag has been employed over the appendix region, only the posterior half of the zone is present.

Diagnosis has been aided in a considerable number of the patients by the presence of the zone, especially in that large class of acute cases in which the abdomen is rigid and there is no palpable mass. The zone has been of the greatest value in helping to differentiate between diseases of the appendix, on the one hand, and those of the gall-bladder or right uterine adnexa, on the other.

We have already stated that the absence of a zone is of no significance. But if a patient complains of symptoms which resemble appendicitis, and a zone is not present in the right lower abdomen, it is well to look elsewhere for hyperalgesia. Thus, we have seen several cases of beginning pneumonia that had considerable pain, tenderness, and rigidity in the right iliac region, in which hyperalgesia over the thorax first led to careful examination of the lungs.

Careful examinations in a large number of cases of acute and chronic appendicitis have given the following results: In the majority of cases of chronic appendicitis, or, more properly, cases of appendicitis admitted for operation in the interval, we have found no zone. In some patients, who entered the hospital with the history of a recent attack, a zone of hyperalgesia could be demonstrated. We tabulate the acute cases:

	Cases.	Zone present.	No zone.
Acute appendicitis	20	14	6
Acute appendicitis with peritonitis	21	17	4
Acute appendicitis with abscess	35	21	14
Acute appendicitis with abscess and peritonitis	15	12	3
Acute appendicitis, gangrenous and perforating	15	13	2
Empyema	8	5	3
Total	114	82	32

Thus, in over 70 per cent. of the patients with acute appendicitis the characteristic hyperalgesic zone was present. It was complete, extending from the median line in front to the median line behind, and with characteristic outline in the greater number of the cases. In more than 50 per cent. of the patients with an abscess and a history of more than six days' duration the zone was absent. If these cases are excepted, the "appendix zone" was present in almost 80 per cent. of patients with recent acute appendicitis.

In the following are given short histories of some cases of special interest:

Acute Appendicitis (Retrocecal). Three days' history of severe pain in the right upper abdomen, radiating to the right flank, one chill, and fever. Rigidity of the whole right rectus. Marked tenderness at two points: one in the right hypochondrium in the axillary line, the other at McBurney's point. Markedly developed anterior appendix zone. The appendix found adherent to the anterior surface of the kidney.

Acute Appendicitis, with Jaundice. Five days' history of severe cramps in the right half of the abdomen, that localized a little below the umbilical level. The right rectus was equally rigid above and below. No mass. Moderate fresh icterus of the skin and conjunctivæ. Markedly developed anterior appendix zone. At operation, liver and gall-bladder were normal. The jaundice was due either to toxemia or to gastroduodenitis.

Acute Appendicitis, with Appendix Zone and Zone for the Right Adnexa, which were Secondarily Inflamed. On admission there was a twenty-four hour history of pain in right lower abdomen, and vomiting. There was no fever. Moderate tenderness over McBurney's point. No zone. The next day, the symptoms persisting, there was a markedly developed complete appendix zone. That evening a zone for the right uterine adnexa developed in addition to the appendix zone. At operation the appendix overlay the right tube, which was acutely congested. Two days after operation the zone for the right adnexa, which began to fade twenty-four hours after operation, was gone.

Acute Gangrenous Appendicitis; Chronic Pyosalpinx. After a puerperal infection two years ago there had been pain in the right lower abdomen, radiating down the thigh, leukorrhœa, and dysmenorrhœa. Occasional exacerbations of the pain, with chilly sensations and fever. Three days before admission there was an attack of severe pain in the right lower abdomen, and vomiting. Marked tenderness in the right iliac fossa and marked rigidity of the right lower rectus. No mass felt through the abdomen. By vagina there was an elastic, slightly tender mass in the right vaginal vault. Moderately developed complete appendix zone. At operation, in addition to the appendix lesion, there was an old adherent pyosalpinx.

Acute Appendicitis in the Puerperium. Six weeks before admission patient was delivered of a child. During the puerperium there was fever and pain in the right lower abdomen. After the two weeks' puerperium pain in the right lower abdomen continued. Three days before admission pain became more marked, cramp-like, and accompanied by fever. There was marked tenderness and rigidity of the right lower abdomen. Marked tenderness in the right vaginal vault. Moderately developed complete appendix zone.

Acute Appendicitis; General Purulent Peritonitis. Symptoms began four days before admission, with general cramps that never localized, and vomiting. The patient entered the hospital in a moribund condition, with the signs and symptoms of an advanced peritonitis without any focal signs. There was a moderately developed anterior appendix zone. Patient was not operated on; the postmortem showed the lesion.

In the general discussion of hyperalgesic zones attention was called to the significance of *sudden appearance and disappearance of zones*, with persisting symptoms. We summarize here our experience in appendicitis:

Gangrene of the Mesenterium of the Appendix. For four days there had been slight pain in the right lower abdomen. On admission temperature and pulse were normal; there was no pain, and only very slight tenderness in the right iliac region. There was a markedly developed complete appendix zone. The next day chill; temperature, 104.2°; abdominal signs unchanged. The zone had disappeared. Immediate operation disclosed an acutely inflamed appendix, with complete thrombosis and gangrene of the mesenterium.

Ruptured Appendiceal Abscess. Patient entered the hospital with a small, very tender mass in the appendix region. There was a moderately developed anterior appendix zone. Patient complained of slight cramps in the right lower abdomen. Two hours after admission the cramps had ceased, but the patient looked much worse, and the whole abdomen was rigid. The zone had disappeared. At the operation, the abscess was found discharging pus into the general peritoneal cavity.

Ruptured Appendiceal Abscess. On admission, patient complained of slight pain in the right lower abdomen, where there was an egg-sized, very tender mass. There was a markedly developed complete appendix zone. One-half hour later cramps became generalized, and the abdomen was rigid, and there was only a slightly developed irregular appendix zone. Findings at operation as in the former case.

Ruptured Appendiceal Abscess. On admission, an orange-sized mass, with slight rigidity of the lower right rectus. Patient complained of very slight pain. There was no zone. Three hours later there was more pain of crampy character; otherwise the symp-

toms and signs were unchanged. A moderately developed anterior appendix zone had appeared. At operation the abscess was leaking pus at one point into the general peritoneal cavity.

Appendicitis in Typhoid Fever. We have seen four cases of acute ulcerative and one case of subacute appendicitis that developed in the course of typhoid. All of them except one of the acute ulcerative cases had well defined appendix zones. All of the cases had pain and tenderness. In one of them the nature of the zone helped in differentiating from typhoid perforation.

INTESTINES. Irregular areas of hyperalgesia were present in some of the cases of intestinal tumors and of intestinal obstruction that we have studied, but they have no uniform shape and do not seem to be of any value. The only intestinal lesions in which there was uniformity in the zones were ileocecal tuberculosis and perforation of the ileum.

Ileocecal Tuberculosis. The zone that we have seen in these cases was a large area of hyperalgesia occupying the whole right lower abdomen down to Poupart's ligament, often extending a little to the left of the median line, and posteriorly becoming lost about the posterior axillary line. In nine cases the zone was present five times. In one case with abscess formation and a three weeks' history, the zone was the only finding that militated against the diagnosis of appendicitis abscess. In another case, with vague pain and melena, the zone gave the first suggestion that the lesion—induration of the ileocecum and adhesions—was in the right lower abdomen.

Perforations of the Ileum. In several cases of free typhoid perforations of the ileum a zone was not present. All the patients were delirious, and at operation there were gas and feces in the general peritoneal cavity. We saw two slow typhoid perforations, both presenting marked zones; their histories are very much alike, and we give one:

During the whole third week of the disease the patient complained of colicky pain in the right lower abdomen, which on the day of admission (twenty-third day of illness) had become more marked. The patient was delirious. The whole abdomen was rigid. Exceedingly marked objective zone, resembling the zone in ileocecal tuberculosis, but extending more to the left of the median line. At operation the lower ileum was adherent and feces were present only in the pelvis.

We saw only one case of perforated tuberculous ulcer of the lower ileum that presented a history like appendicitis, and in which the only finding against appendicitis was a zone like that of the slow typhoid perforations. This, too, was a slow perforation, the loop of gut involved being found wrapped in omentum.

UTERUS AND ADNEXA. Head describes differences between the zones for the uterus, the ovary, and the tube, which we have been

unable to verify. The zone for the right adnexa lies on the right half of the median line; that of the left adnexa on the left half; the zone for the uterus is a combination of the two.¹¹ There is no difference between the zones for the right and left adnexa. Beginning some distance above Poupart's ligament, the upper margin of the zone runs parallel to it, and pursues this obliquely upward course to the spine of the second lumbar vertebra (approximately). The lower margin is a long, tongue-like process that extends half-way down the thigh on its inner aspect. The lower margin, as it passes a short distance below the anterior superior spine of the ileum, approaches the upper, the average breadth of the zone here being three inches. The lower border then passes horizontally backward over the buttock to reach the posterior median line partly over the sacrum. Sometimes the upper half of this zone is better developed, sometimes the lower; these may be considered maxima.

Diagnosis in the diseases of the uterus has not been aided by the presence of a zone, and we will therefore dispose of this heading briefly. In about half of the cases of dysmenorrhœa and of endometritis with pain the zone was present. Some of the cases of retroflexion, retroversion, ante flexion, and prolapse showed the zone. It was present in the five cases of uterine polyp that we observed (all of them had pain). It was not present in tumors of the uterus, except in a few cases.

In diseases of the tubes and ovaries, especially those of the right side, the zones have been of diagnostic value.

	No. of cases.	Zones present.
Pyosalpinx, acute	9	9
Pyosalpinx, acute, double	3	2
Salpingo-oöphoritis	7	4
Salpingo-oöphoritis, double	5	4
Ovarian abscess	3	2
Ovarian cyst, twisted	3	3
Ectopic gestation	9	5
Total	39	29

A large number of cases that presented few or no symptoms have not been included in the above list, because the majority had no zones. There were no zones in a large number of patients with tumors and cysts of the ovary.

We present some illustrative cases in which the presence of the zone aided diagnosis:

Bilateral Acute Suppurative Salpingitis; Seropurulent Peritonitis. Physical signs of appendicitis, with a small mass low down in the right iliac region. Marked zone for the right, less marked zone for the left adnexa. At operation, the right tube showed the

¹¹ It is very difficult to determine a separate zone for the uterus, because in so many cases in which the uterus is diseased the adnexa, too, are diseased.

more marked lesion, the palpable mass being made of omentum that enwrapped it.

Right Suppurative Salpingitis; Diffuse Purulent Peritonitis. The patient, aged fifty-five years, entered the hospital in a delirious condition. Her history indicated appendicitis. The abd men presented the signs of a generalized peritonitis; no focal signs. There was a marked zone for the right adnexa.¹²

Right Pyosalpinx; Streptococcic Peritonitis. Abdomen rigid and tender throughout. History suggested perforated gastric ulcer. Marked zone for right adnexa, slight zone for left adnexa. Vaginal examination negative. At operation the left tube was deeply congested; contained streptococci. Pus from right tube showed streptococci.

Left Twisted Ovarian Cyst Lying on the Right Side. Three days' history in a patient, aged seventeen years, suggesting appendicitis. Marked tenderness and slight rigidity of the right lower abdomen. Tenderness and fulness on the right side by rectum. Marked zone for the left adnexa. At operation the cyst, springing from a long pedicle, lay behind the right uterine adnexa. The correct diagnosis in this case was suggested by the Head zone alone.

VII. CONCLUSIONS.

1. We agree in the main with the statements of Head, that there are present, in many affections of the abdominal viscera, constant and definite areas or zones or cutaneous hyperalgesia.

2. These zones may vary somewhat in extent and in outline, but they have a characteristic location.

3. The presence of a characteristic zone is an evidence of an affection of the corresponding abdominal viscus, although not of necessity the affection which is causing the symptoms.

4. The zones are present in a large percentage of patients with acute affections of the appendix, of the gall-bladder, of the uterine adnexa, and are of considerable value in the diagnosis of these acute affections.

5. Zones are frequently present in acute disease of the other abdominal viscera, and when present aid in making the correct diagnosis.

6. Cutaneous hyperalgesia may appear early in acute abdominal disease. Its presence is no index of the gravity of the lesion. Its sudden disappearance may be of grave significance.

¹² At the postmortem examination there were streptococci in the small amount of pus in the right tube. Cultures from the vagina and from the uterus showed streptococcus. Cultures from the left tube, which contained no pus, were sterile. In the left horn of the uterus was a polyp that completely blocked the uterine opening of the left tube. The case was evidently one of ascending infection. The findings account for the absence of a zone for the left adnexa.

7. In the absence of all other localizing signs or symptoms, the zone may indicate the organ that is affected. In most instances, however, it must not be used to make the diagnosis, but only as a diagnostic aid, to substantiate conclusions reached from a consideration of all the symptoms and signs.

TUMOR OF THE GASSERIAN GANGLION.¹

A REPORT OF TWO CASES, WITH NECROPSY.

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TUMOR arising in the Gasserian ganglion or having its chief clinical manifestations in disturbance of this ganglion is fortunately rather rare, but doubtless far more common than is generally believed. Brain tumor is always serious in its symptomatology, but when the Gasserian ganglion is implicated the pain is usually intense. The first case of tumor in this region recorded in this country, and the second case on record in which operation was performed, is that reported by Dercum, Keen, and Spiller (1900). Since then two cases with necropsy, in one of which operation was done, have come under my care.

CASE I.—A. K., aged twenty-five years, was referred to the University Hospital by Dr. H. S. Crouse, of Littlestown, Pa., March 4, 1907. Dr. Crouse stated that the patient first had paralysis of the right fifth nerve, with severe pain; the right optic nerve was then implicated causing blindness in the right eye, later the left optic nerve became affected causing complete blindness. Then the left arm became paretic. At times the mentality was much impaired, but only when the pain in the head was severe.

The history as obtained after the patient entered the hospital is as follows:

Chief Complaints. Blindness, intense headache, vomiting.

Social History. Patient is a brick layer and stone mason. He is unmarried. He uses beer and whiskey, sometimes to excess. He chews tobacco rather freely. He had gonorrhœa about a year ago, but has no history of syphilitic infection.

Family History. Father and mother are living. Two brothers and three sisters are living and well; one sister died of eclampsia.

¹ Read by invitation at a meeting of the St. Louis Surgical Society, May 29, 1908.

The patient says the members of his family are all more or less "nervous." No family history is obtained of tuberculosis, malignant, cardiac, or renal disease.

Previous Medical History. Is negative except that he has had a number of attacks of tonsillitis.

Present Illness. The patient is in an advanced stage of mental hebetude, probably as a result of bromism, and his statements are vague and unsatisfactory. He says that last winter he began to have weakness and soreness about the articulation of his jaw (whether the right or left side is not stated), the soreness afterward spreading to his head where it has persisted ever since. About two months ago blindness developed in the right eye and this was followed about two weeks later by blindness in the left eye. During this same period he has vomited a number of times. He is not able to walk unless some one leads him. He believes this inability to walk is caused by his blindness. His general health has not suffered much. Headaches of late have been very severe.

Physical Examination. A rather poorly developed and emaciated male subject, looking considerably older than his given age of twenty-five years. Skin is covered with a profuse, deeply colored, red eruption, probably the result of bromides. He has no noteworthy glandular enlargement. Pulse is regular, volume fair. Chest is poorly developed; expansion is fair and equal on both sides. Heart and lungs negative. Abdomen soft and symmetrical. Abdominal organs negative.

March 6, 1907. Examination by Dr. Spiller. The left pupil is much larger than the right. Both irides are immobile to light; slight contraction is obtained of each pupil in attempt at convergence. He says he sees light with each eye separately. He wrinkles the forehead well, closes the eyelids, shows the teeth, and draws up each corner of the mouth well, therefore he has no involvement of either facial nerve. Tactile sensation is completely lost in the entire distribution of the right fifth nerve, provided no pressure is produced. Sensation of pain is lost in the same distribution. Sensation is preserved along the border of the lower jaw in the distribution of the cervical nerves. The conjunctiva and cornea are anesthetic in the right eye but not in the left eye. A piece of paper put far up the right nostril is not felt unless pressure is produced, and causes no lachrymal reflex. The jaw goes distinctly to the right when the mouth is opened. The right tonsil is swollen and the uvula is absent. Sensation of the left nostril is normal.

He is distinctly deaf to the voice in both ears. The soft palate moves very imperfectly on the right side. The sense of smell is greatly impaired on each side. The tongue is protruded straight. Taste for salt and sugar probably is lost on the front and anterior part of the tongue. This may have been only on the right side. The grasp of each hand is fair. The upper limbs move freely in